

### Abstract

Thermal insulation systems and with methods of their production. The thermal insulation systems incorporate at least one reflection layer and at least one spacer layer in an alternating pattern. Each spacer layer includes a fill layer and a carrier layer. The fill layer may be separate from the carrier layer, or it may be a part of the carrier layer, i.e., mechanically injected into the carrier layer or chemically formed in the carrier layer. Fill layers contain a powder having a high surface area and low bulk density. Movement of powder within a fill layer is restricted by electrostatic effects with the reflection layer combined with the presence of a carrier layer, or by containing the powder in the carrier layer. The powder in the spacer layer may be compressed from its bulk density. The thermal insulation systems may further contain an outer casing. Thermal insulation systems may further include strips and seams to form a matrix of sections. Such sections serve to limit loss of powder from a fill layer to a single section and reduce heat losses along the reflection layer.